
Emergency and Abnormal Situations Project

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Human Factors
research and technology



The Challenge

Emergency and abnormal situations:

- are often time critical, complex, and/or ambiguous
- are high stress, high workload, and a great deal is at stake
- require exceptionally high levels of coordination inside and outside of the airplane

Emergency and abnormal procedures:

- are generally focused on aircraft systems rather than on the situation as a whole
- are practiced seldom (twice a year or less) and used rarely
- are often highly dependent on fragile cognitive processes
- **when needed, are crucial and must be performed correctly**



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Industry Contacts and Consultants

Manufacturers:	Boeing, Airbus Industries, BAE Systems
Regulatory Agencies:	FAA, CAA (UK), ICAO
Unions and Trade Groups:	ALPA, APA, SWAPA, ATA
Accident Investigation Bodies:	NTSB, TSB of Canada
Airlines:	Southwest Airlines, United Airlines, Continental Airlines, American Airlines, Fed Ex, Aloha Airlines, Hawaiian Airlines, Air Canada, Cathay Pacific, Airborne Express, UPS, US Airways, TWA (prior to merger)



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Themes from Industry Interviews

- Industry lacks substantive human performance guidelines for the creation, validation, certification, and training of procedures for emergency and abnormal situations.
- Challenging to design procedures that reflect real-world ambiguities, workload demands, time constraints, and cognitive limitations.
- Training provides limited opportunity to practice procedures in the context of full real-world demands
 - LOFT/LOE: one scenario/year
 - Recurrent training focuses on practicing procedures not on concurrent demands (e.g., coordination with ATC, dispatch, and maintenance)



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Taxonomy of the Domain

15 Different Categories of Issues:

-  **Broad, Over-arching Issues**
-  **Issues Related to Checklists and Procedures**
-  **Issues Related to Humans**
-  **Issues Related to the Aircraft**
-  **Issues Related to Training**
-  **Selected Emergency Equipment and Evacuation Issues**

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Taxonomy of the Domain

Philosophies

Philosophies and Policies of Dealing with Emergencies and Abnormal Situations

Aircraft System Focused ----- Situation Focused
Engineering Function----- Human Performance
Ideal-----Context Dependent

Manufacturers

Regulatory Agencies

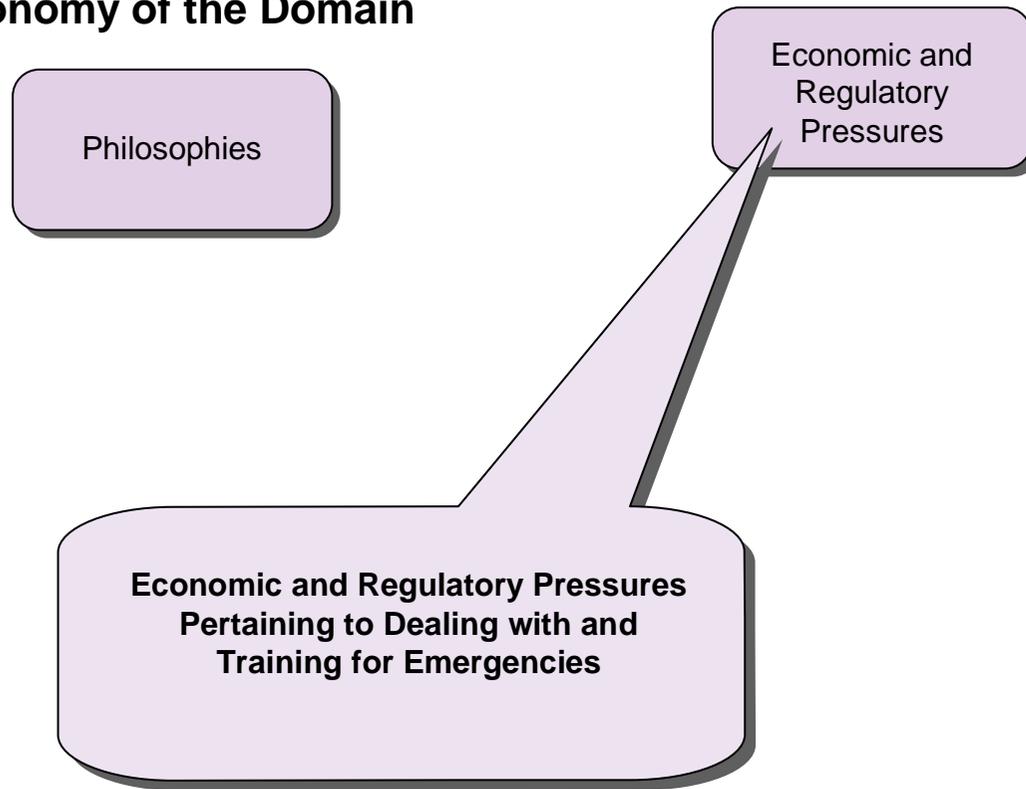
Company (Management, Dispatch,
Maintenance)

Flight and Cabin Crews

ATC

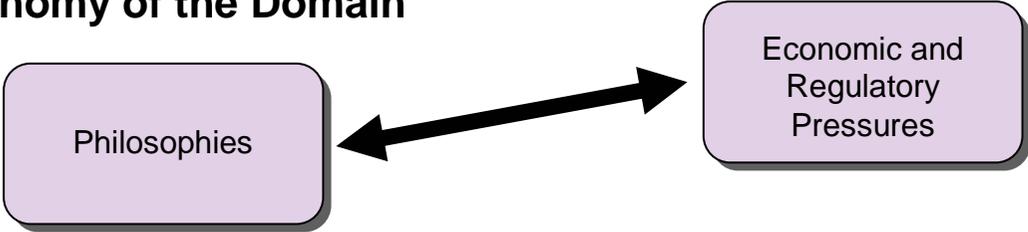
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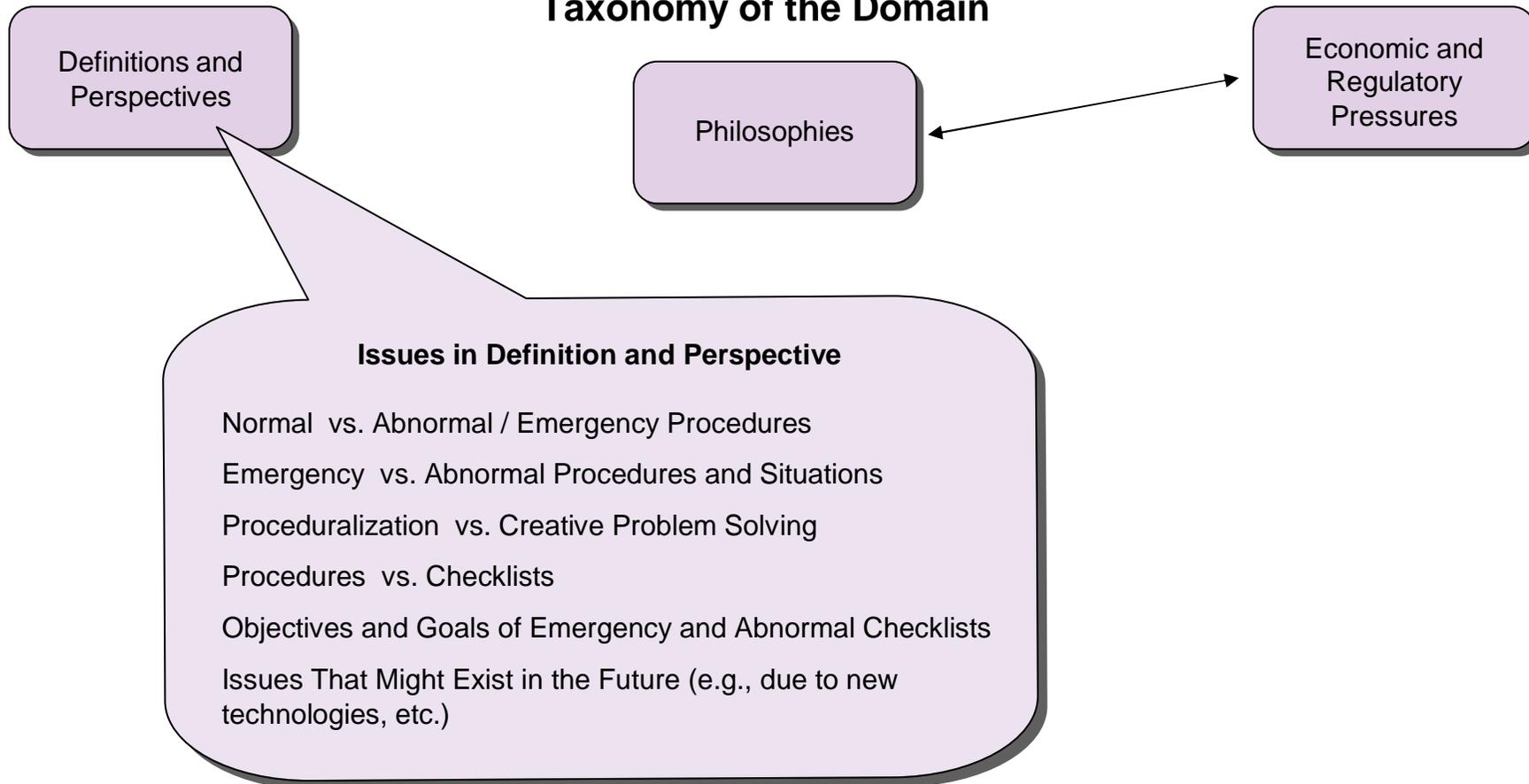
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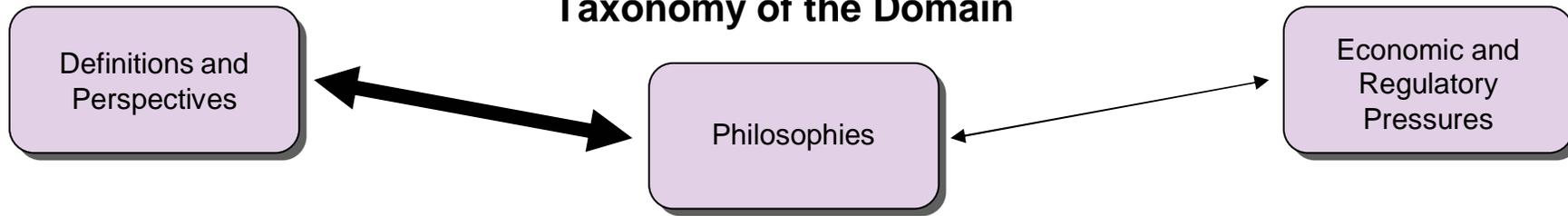
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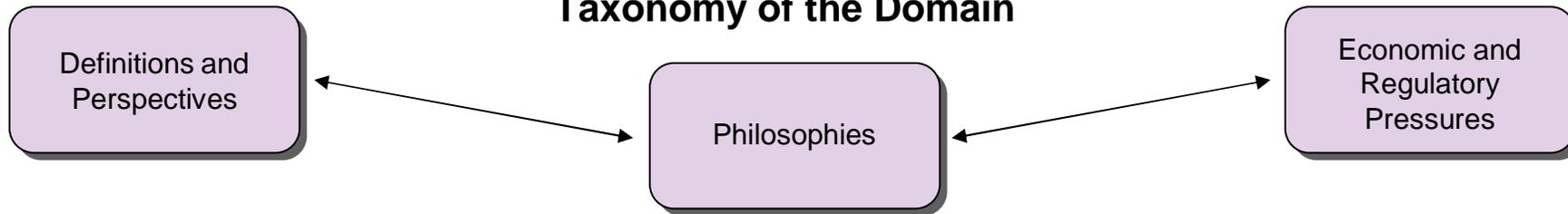
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Development of Checklists and Procedures

Who develops them?

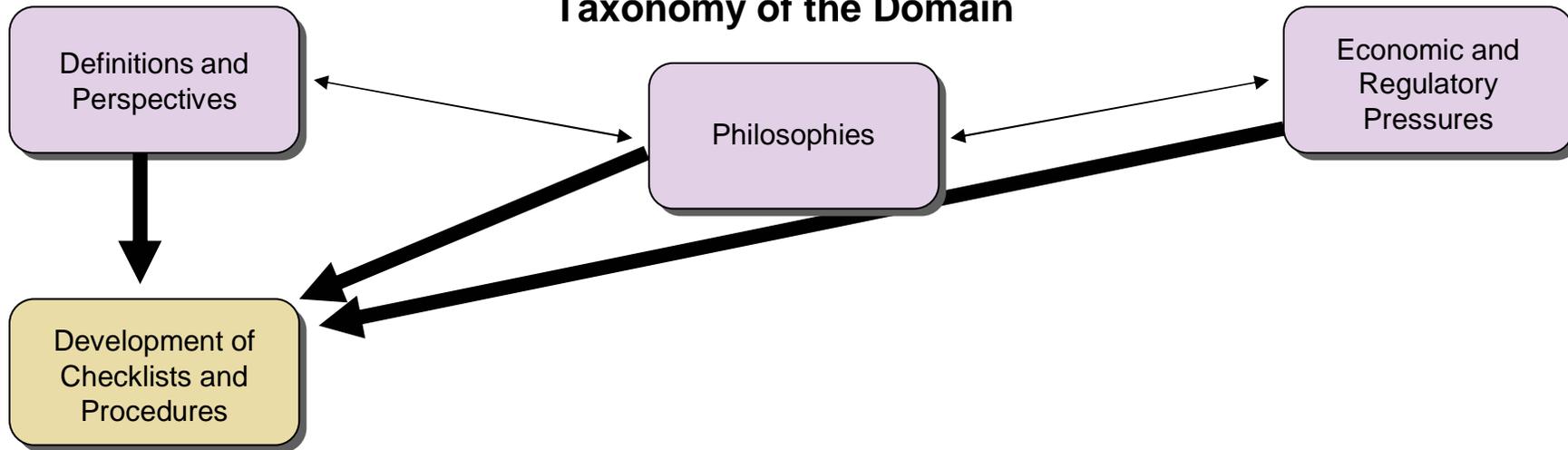
When and how are changes made and recorded?

How do they get regulatory approval?

Degree to which they reflect the operational environment

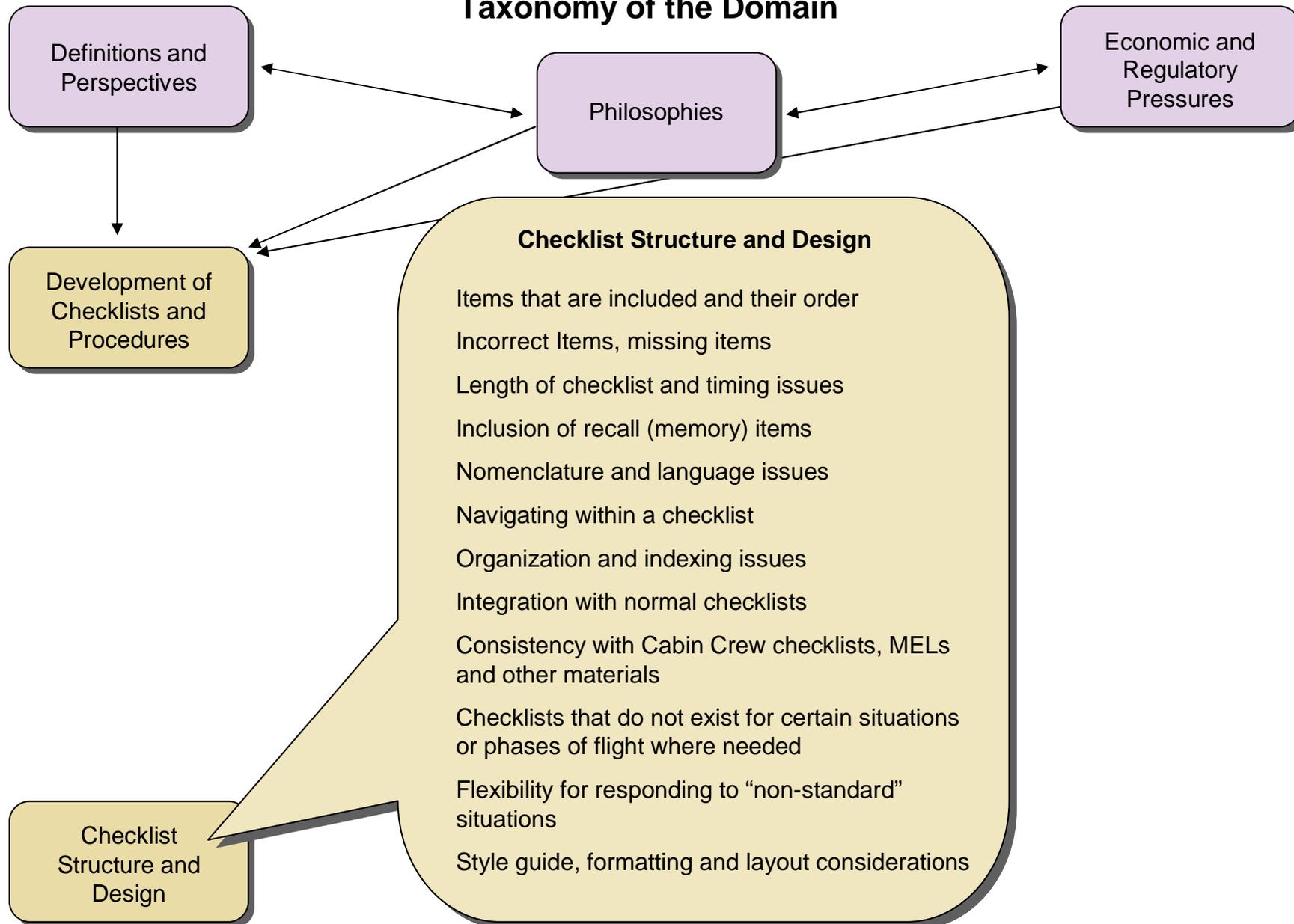
Degree to which they can be standardized across fleets

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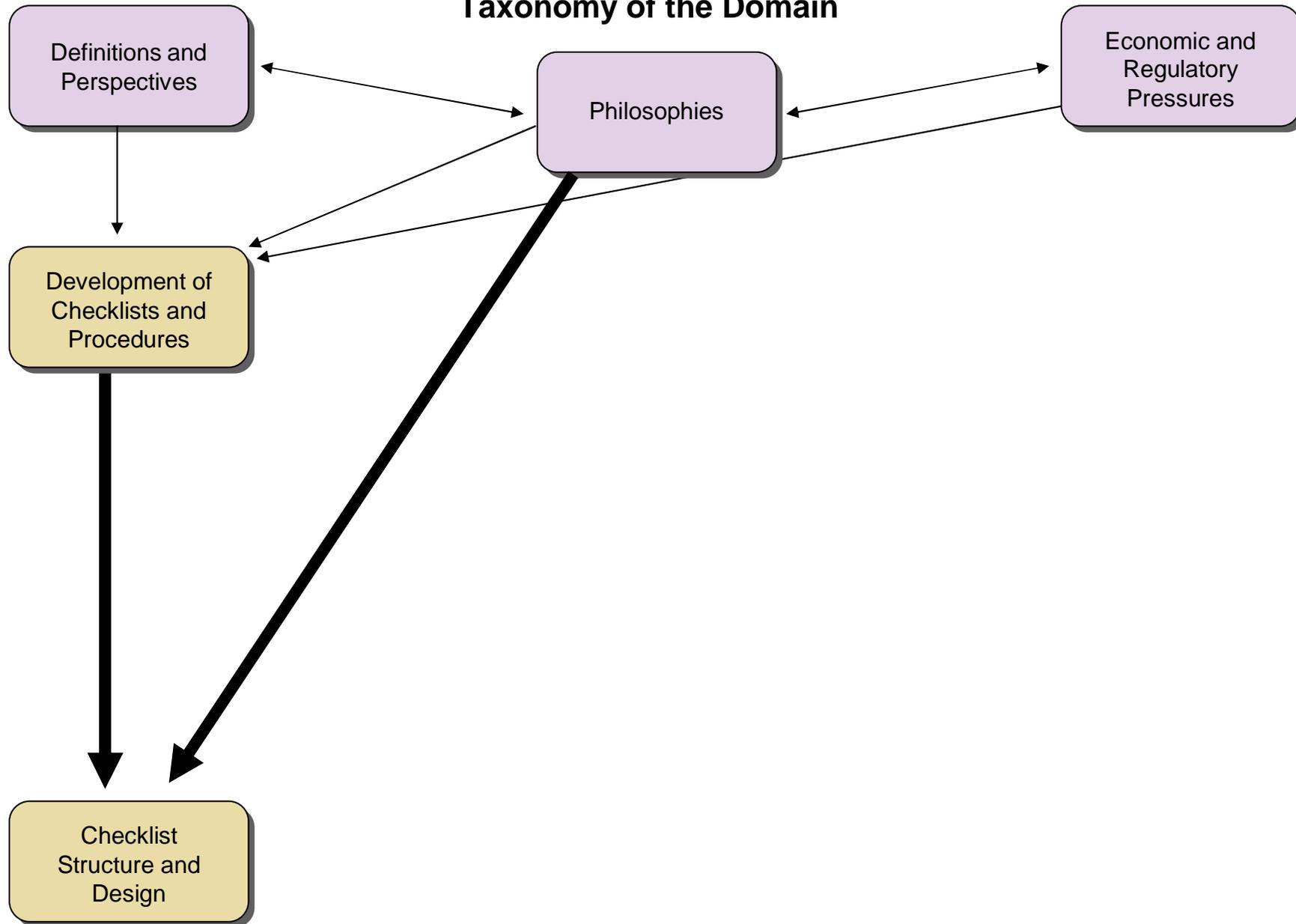


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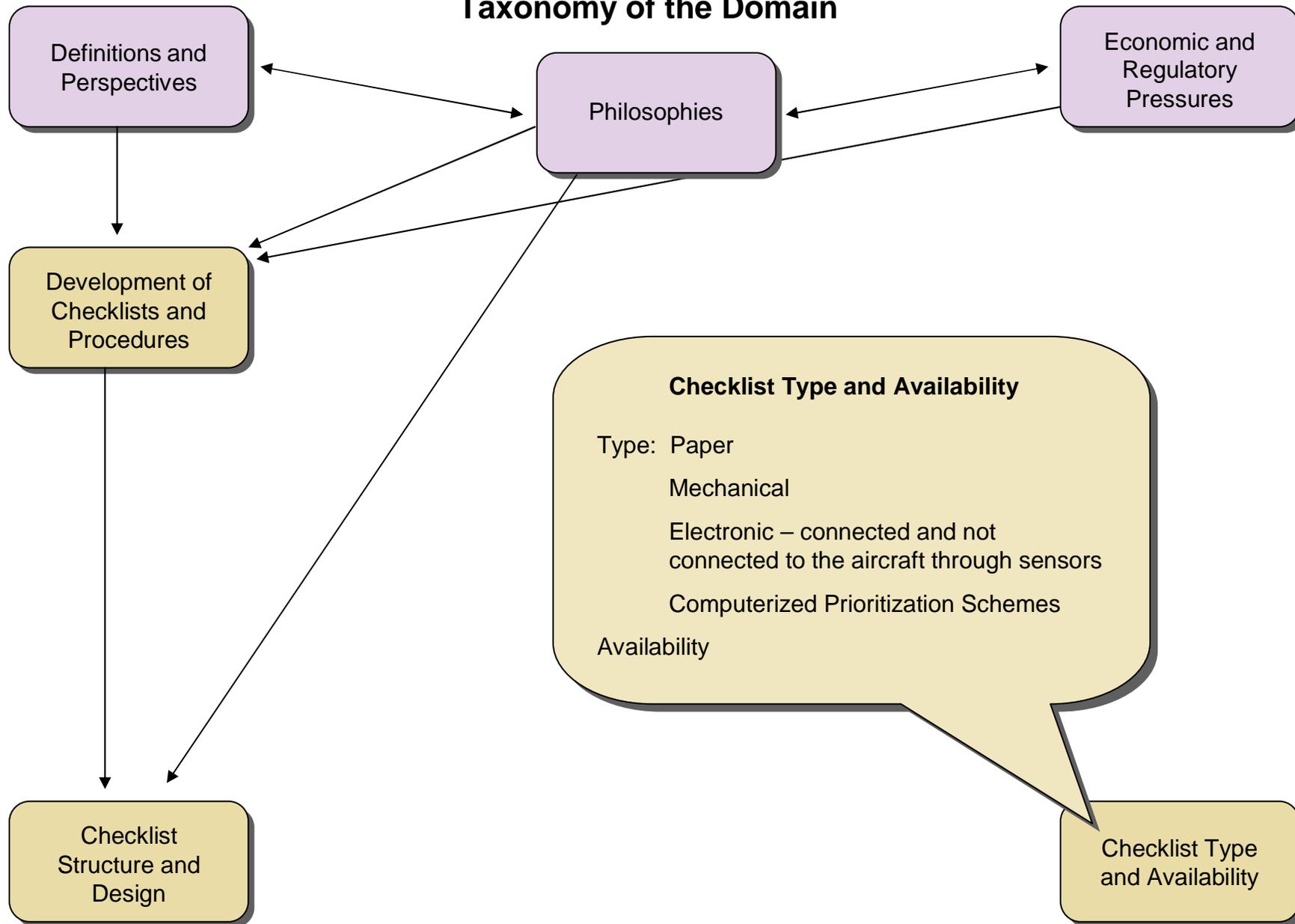


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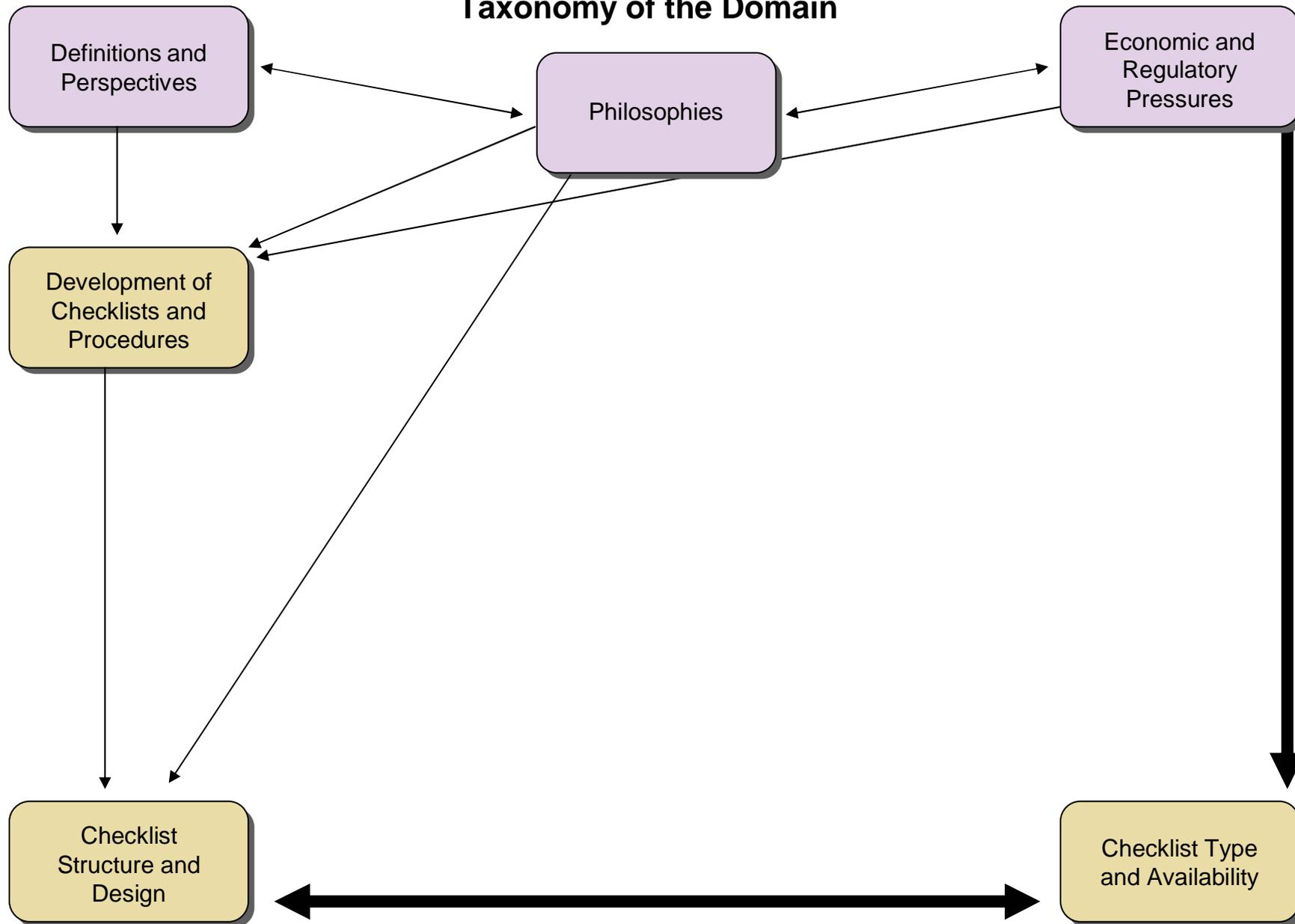


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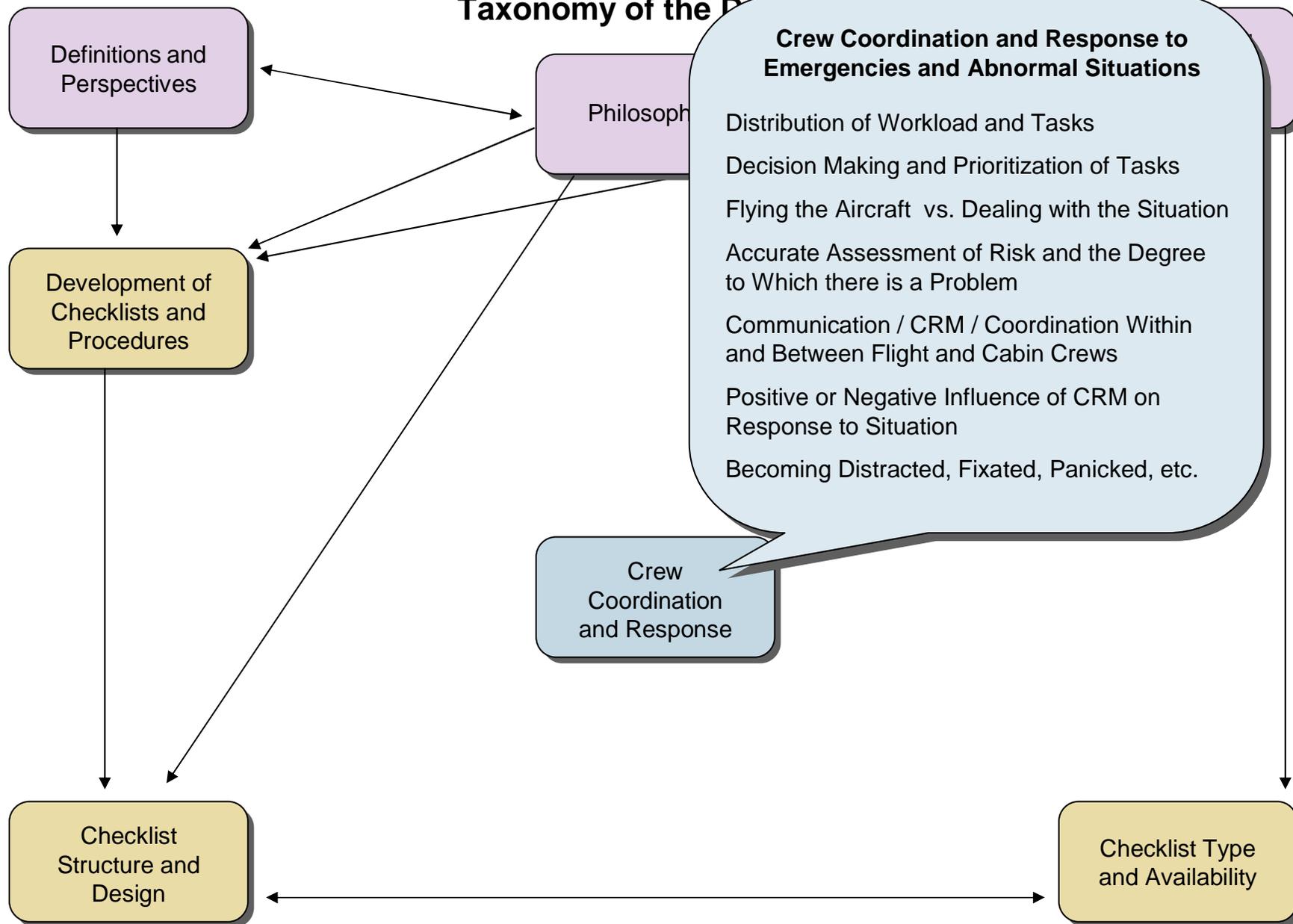


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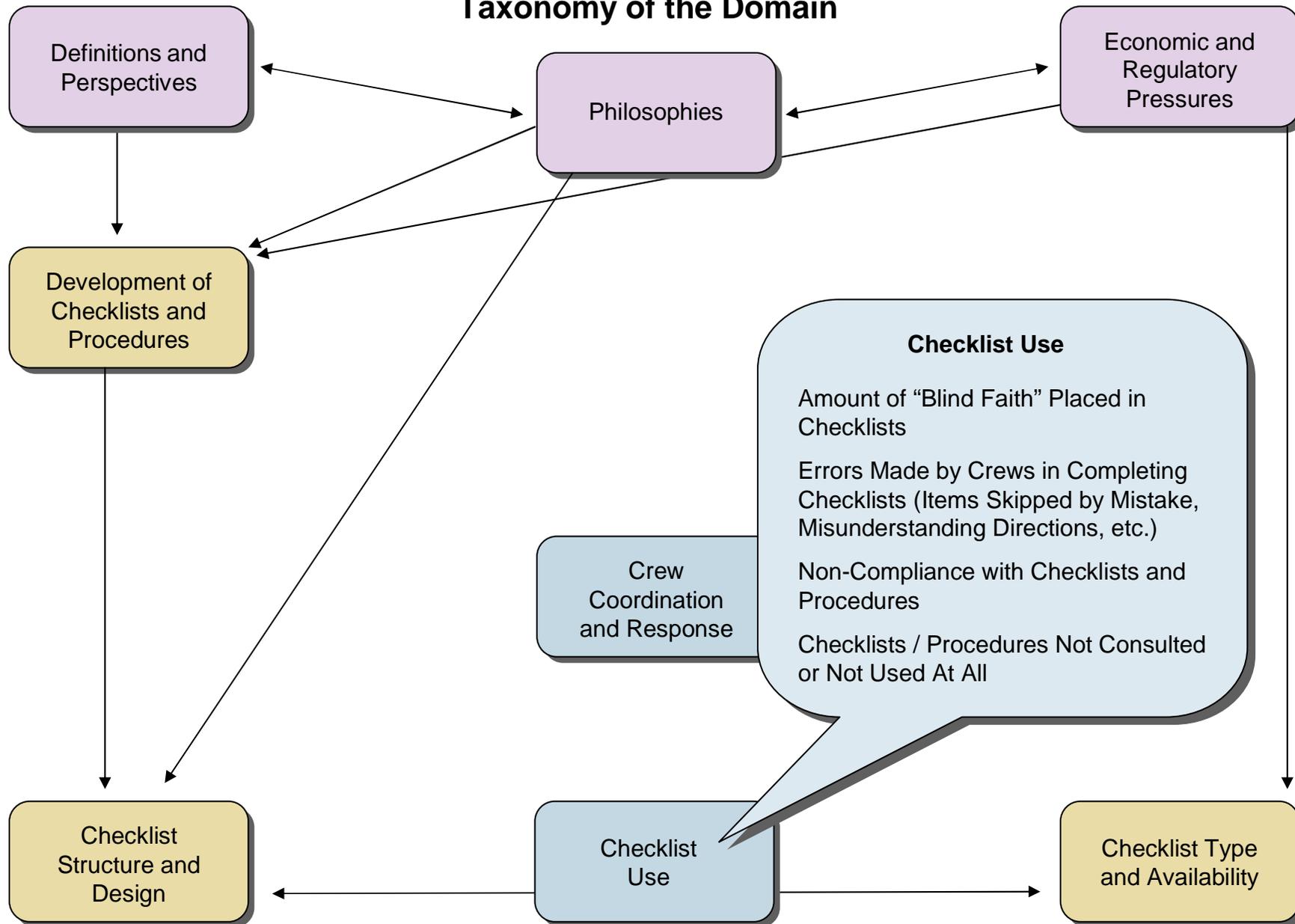
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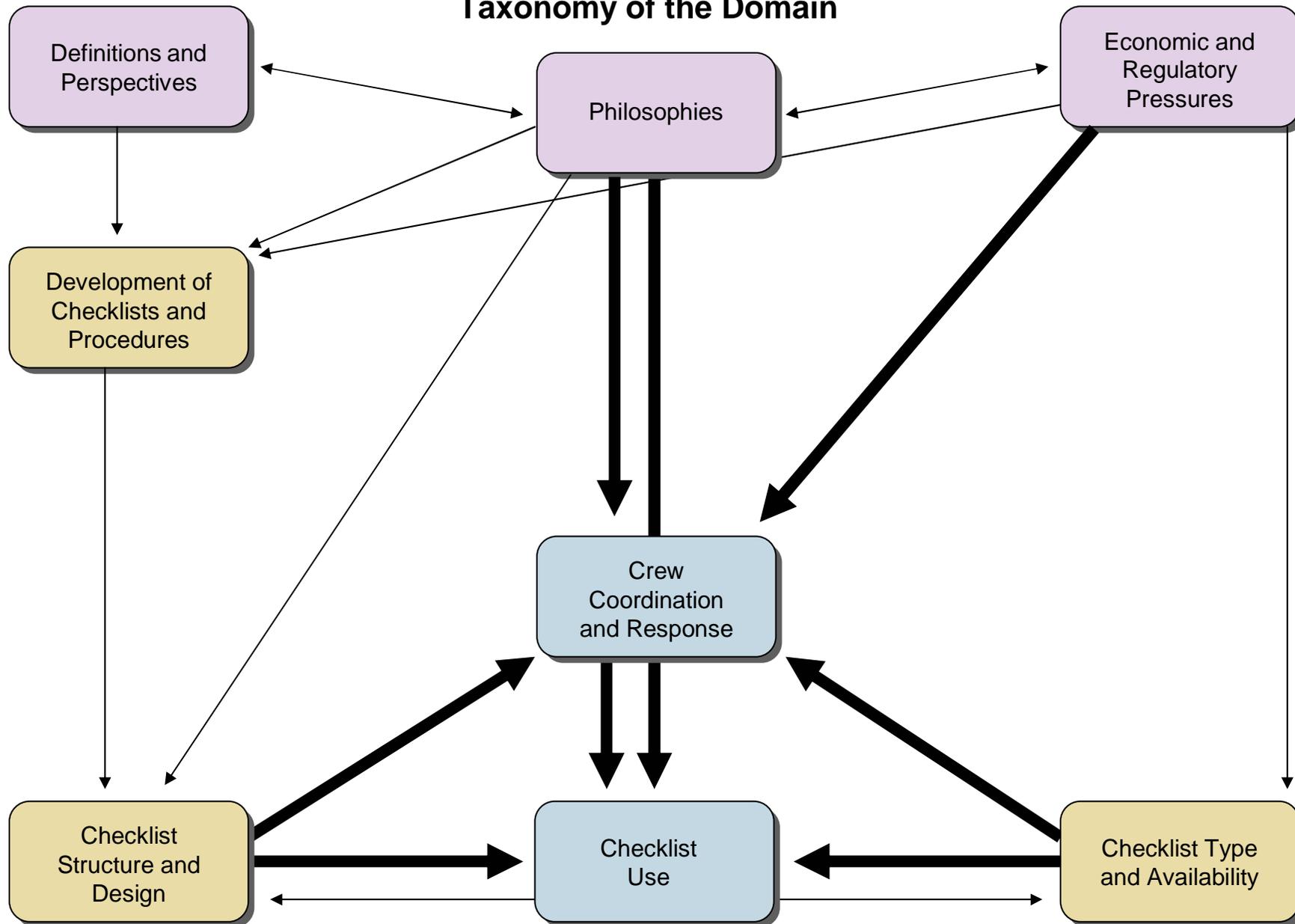
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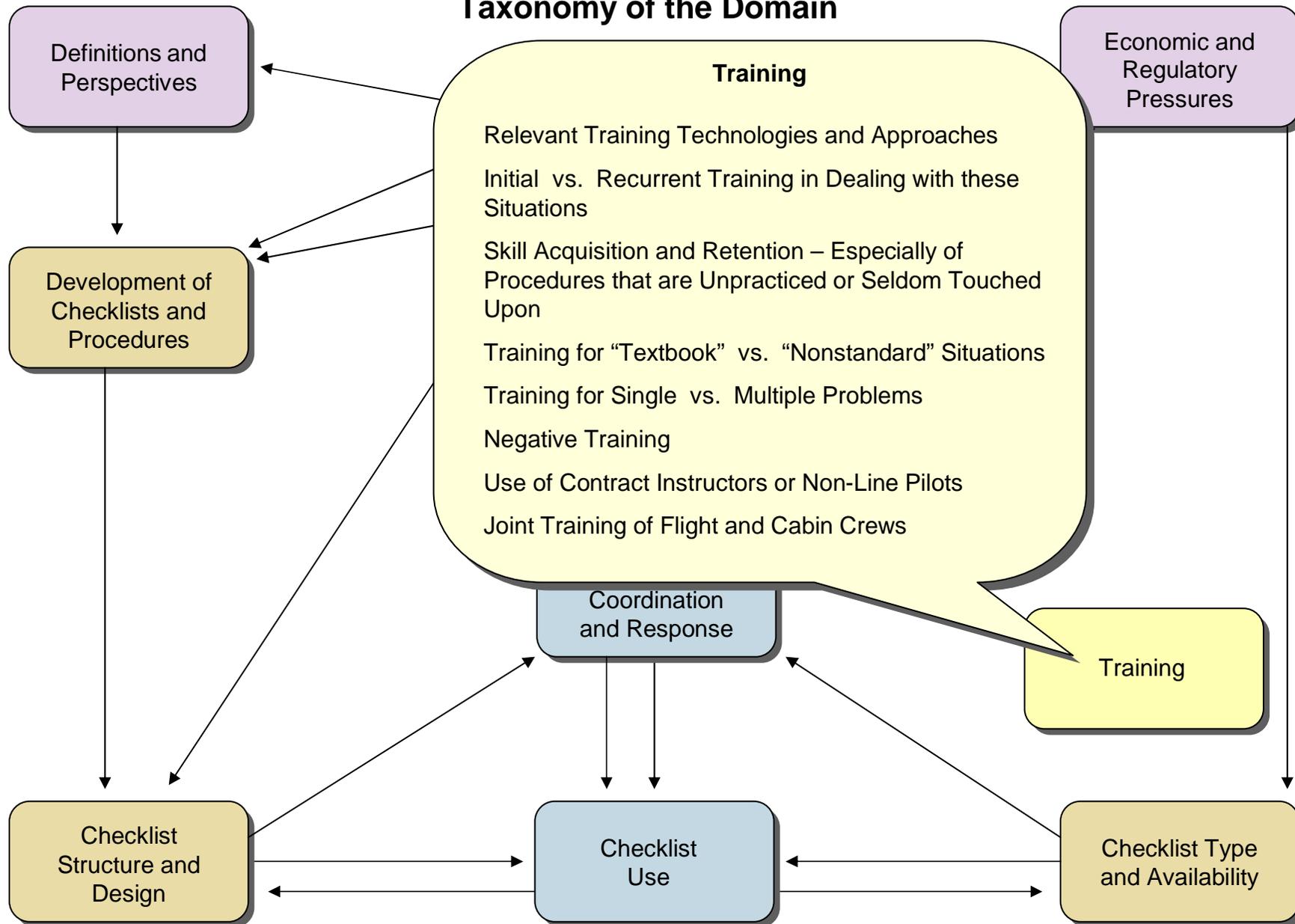
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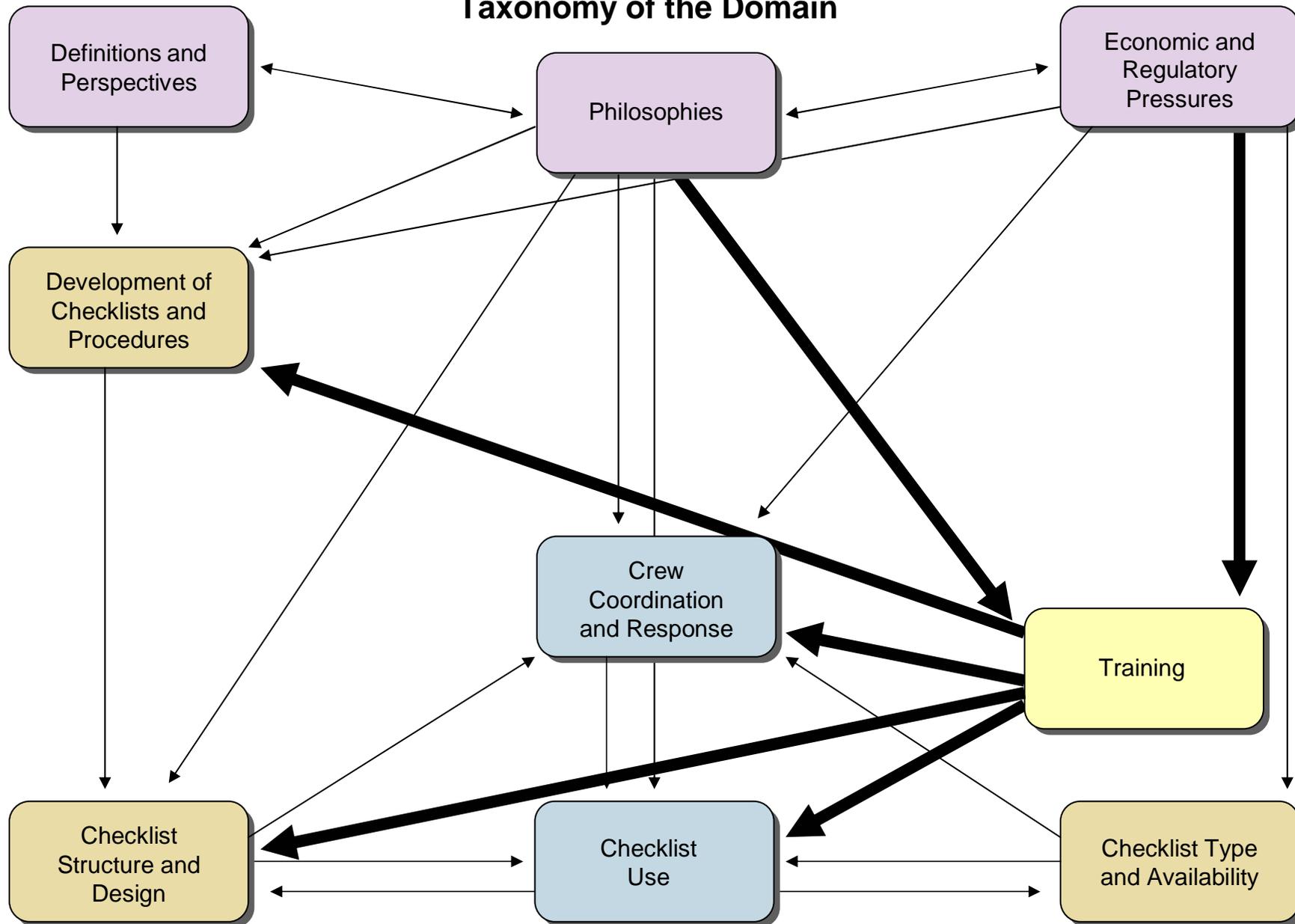
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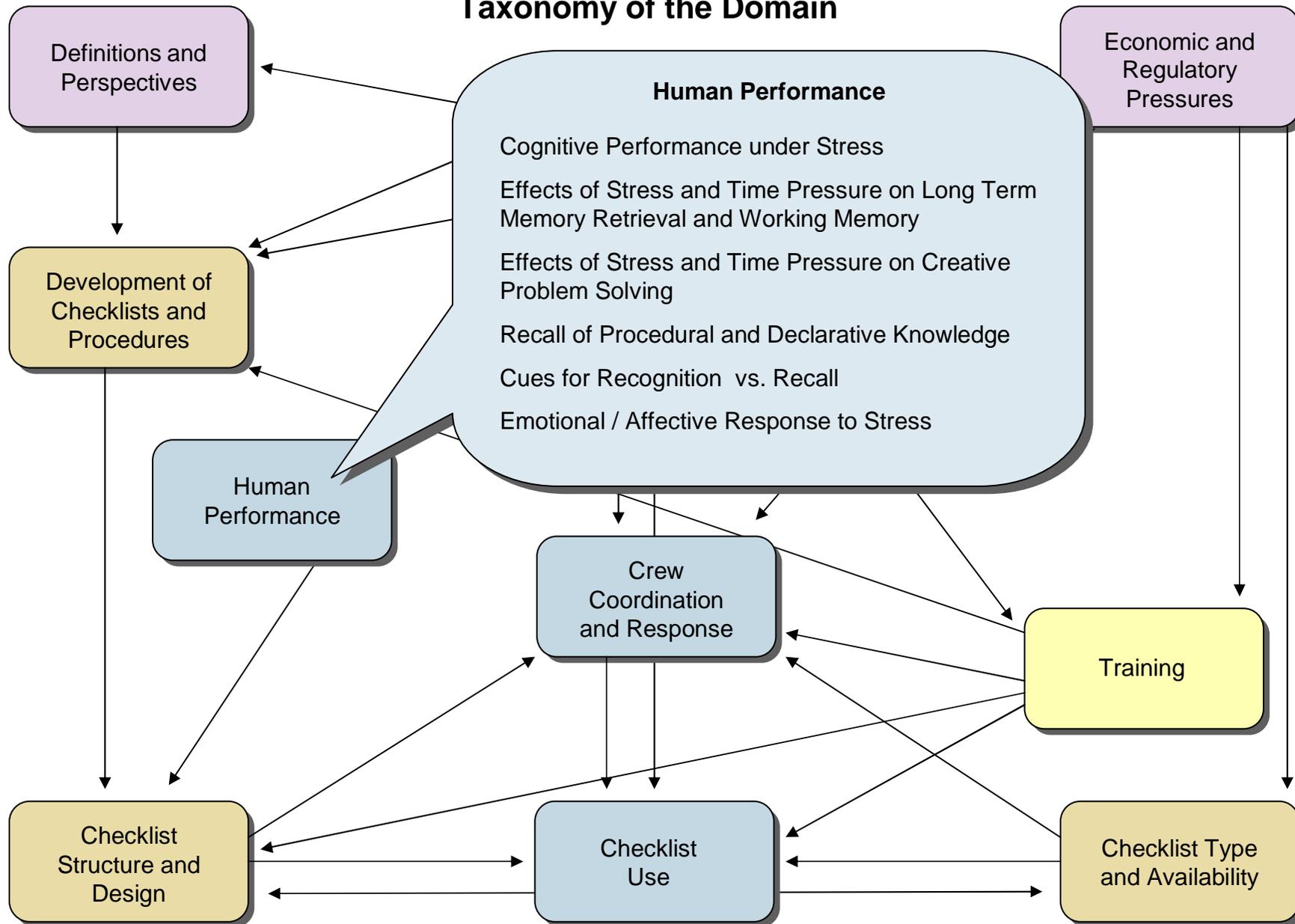
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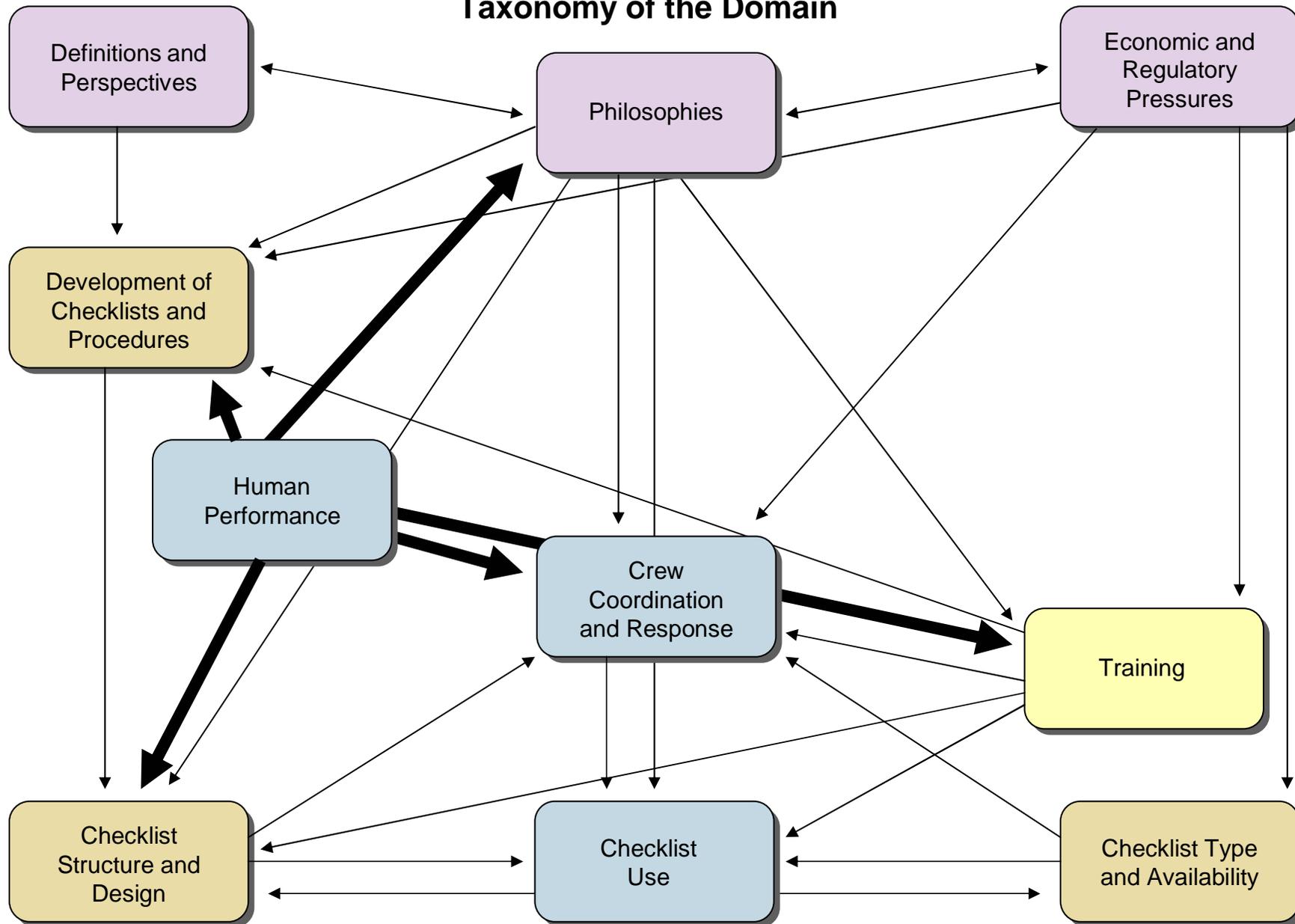
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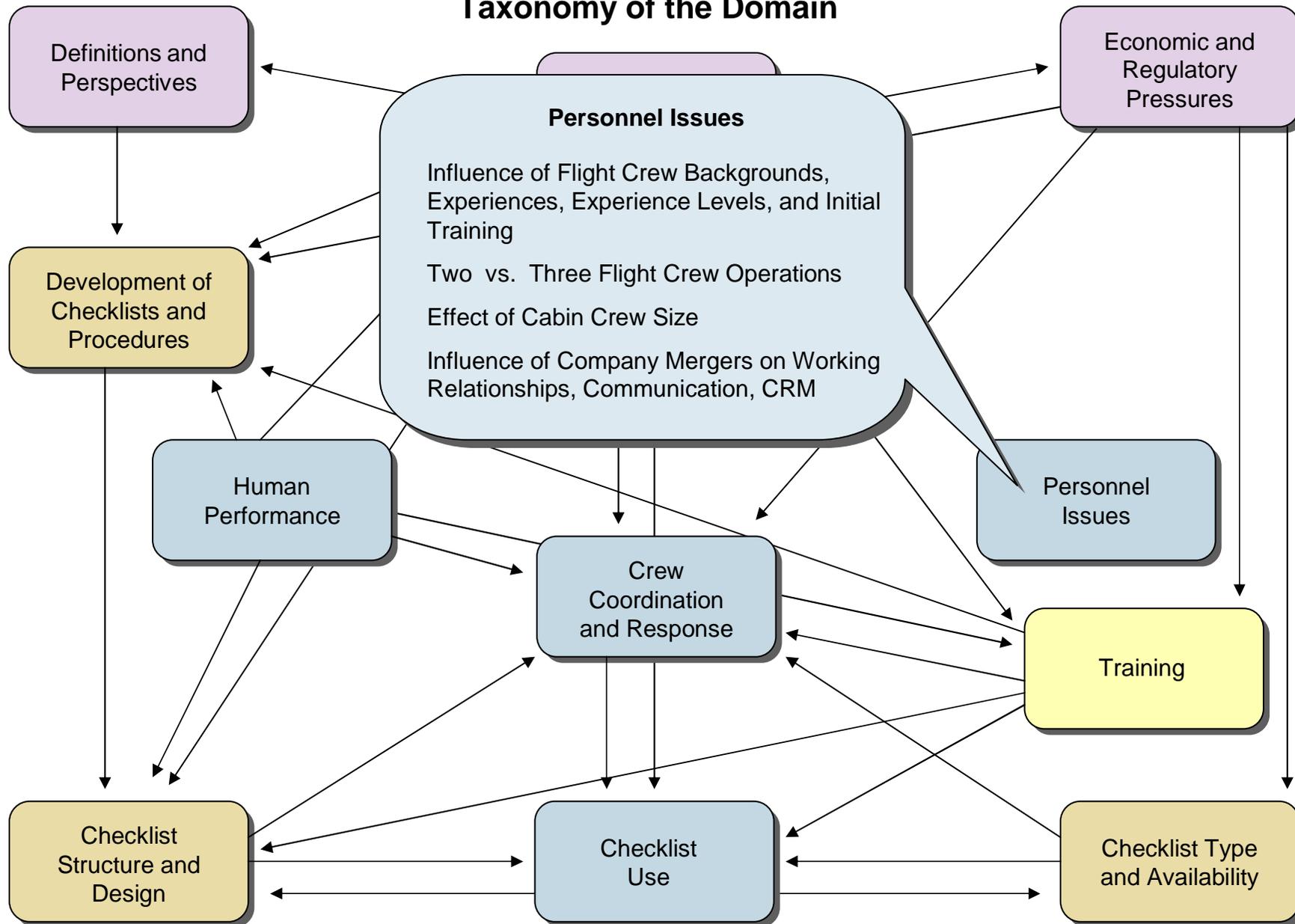
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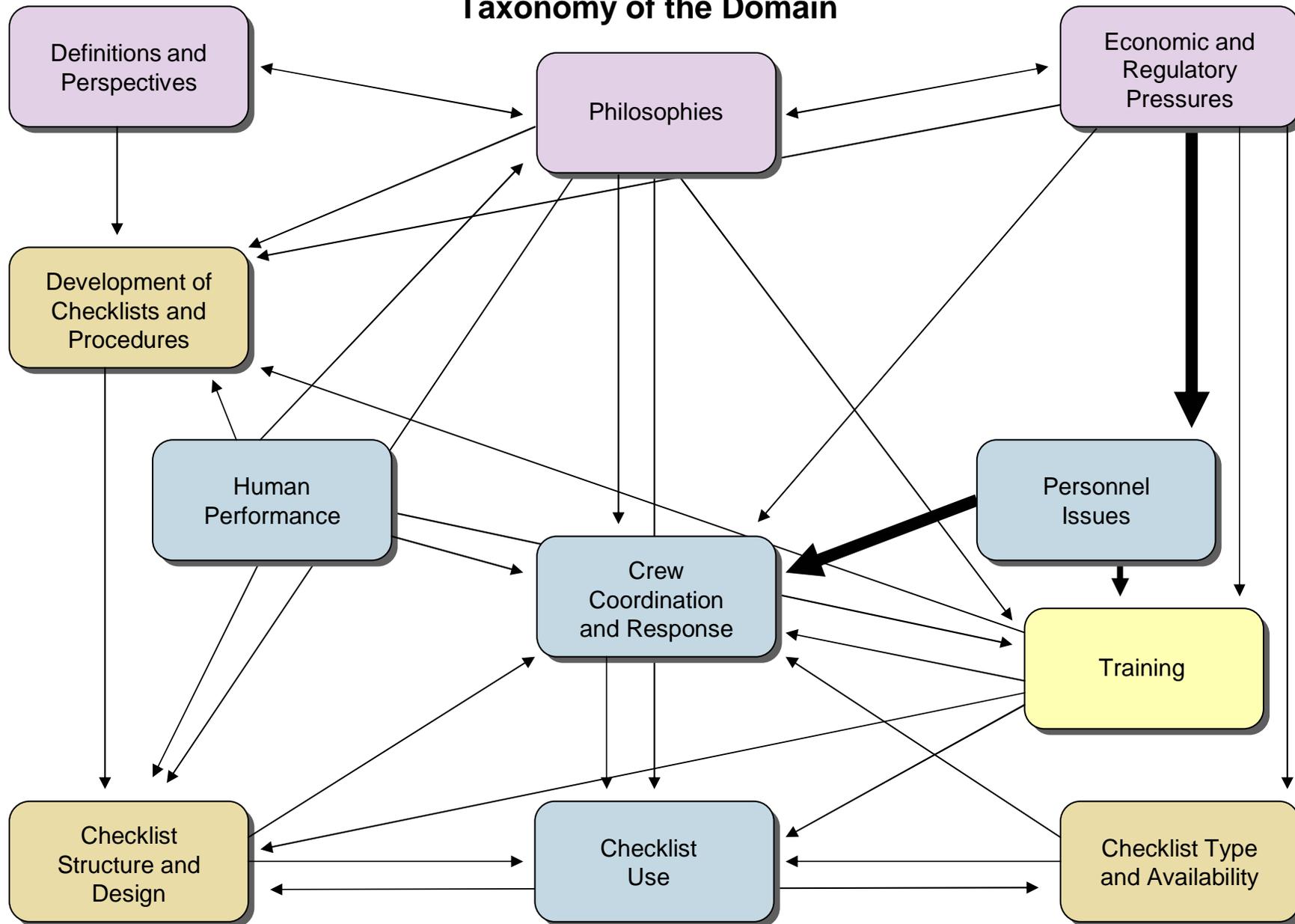
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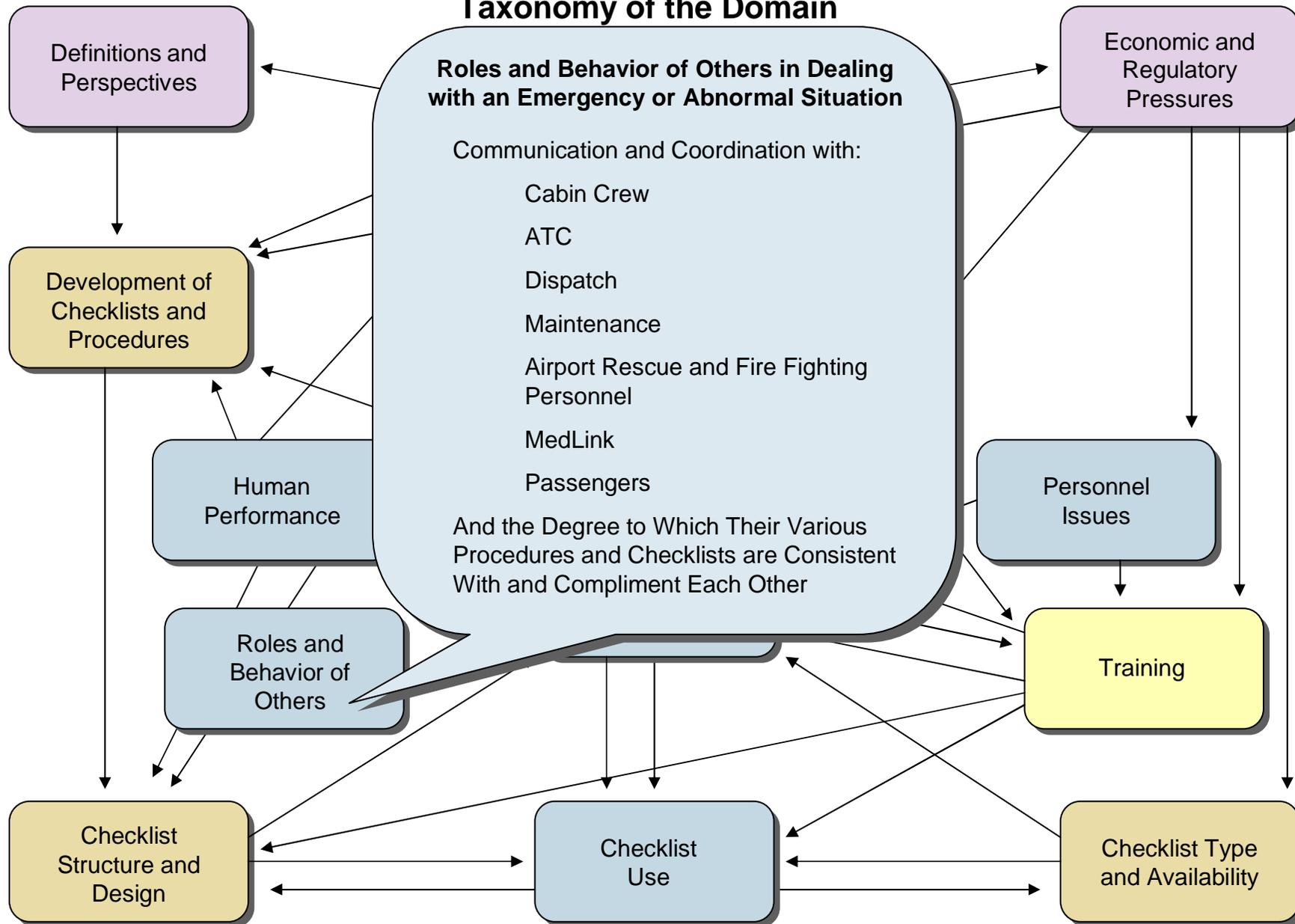
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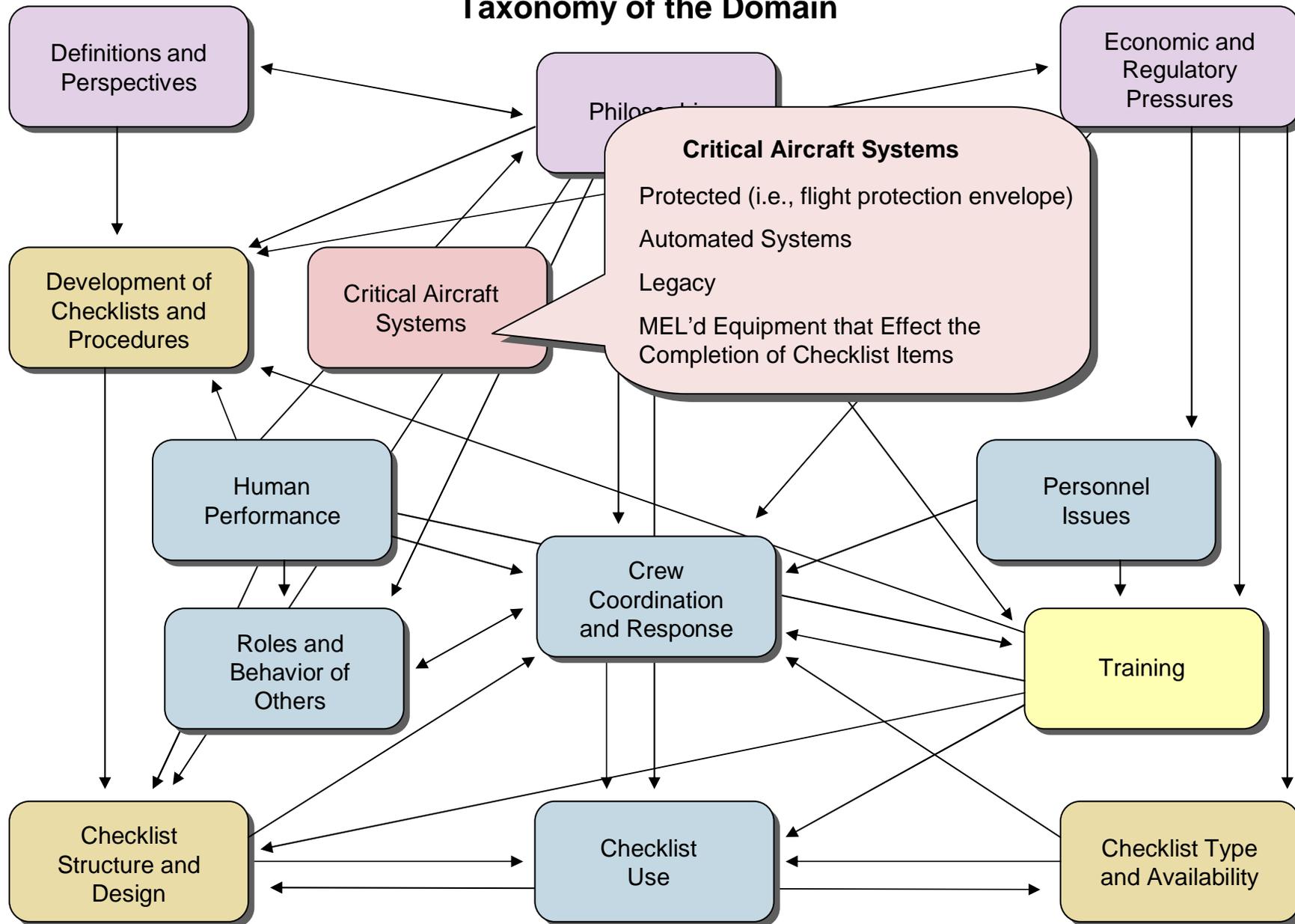
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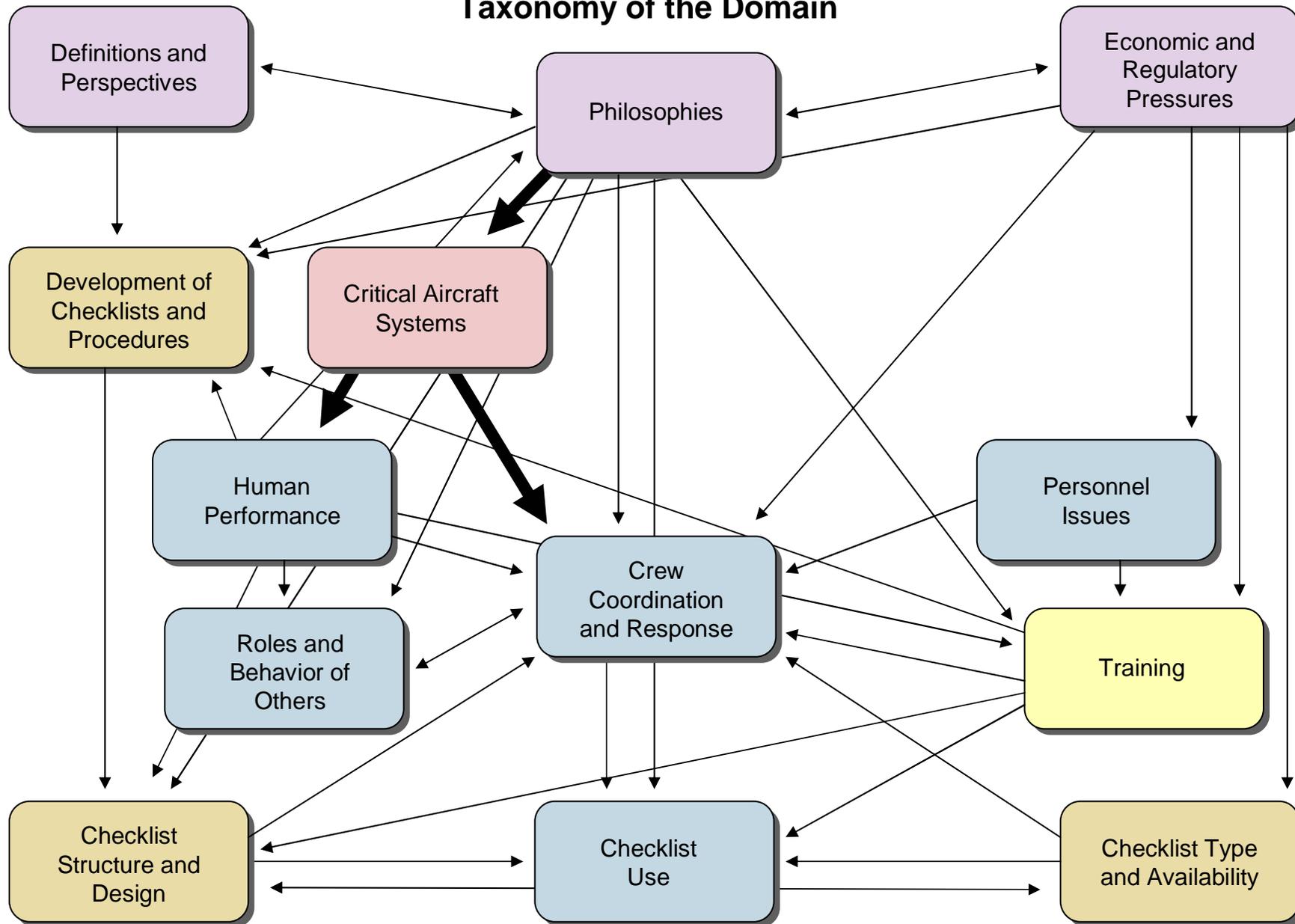
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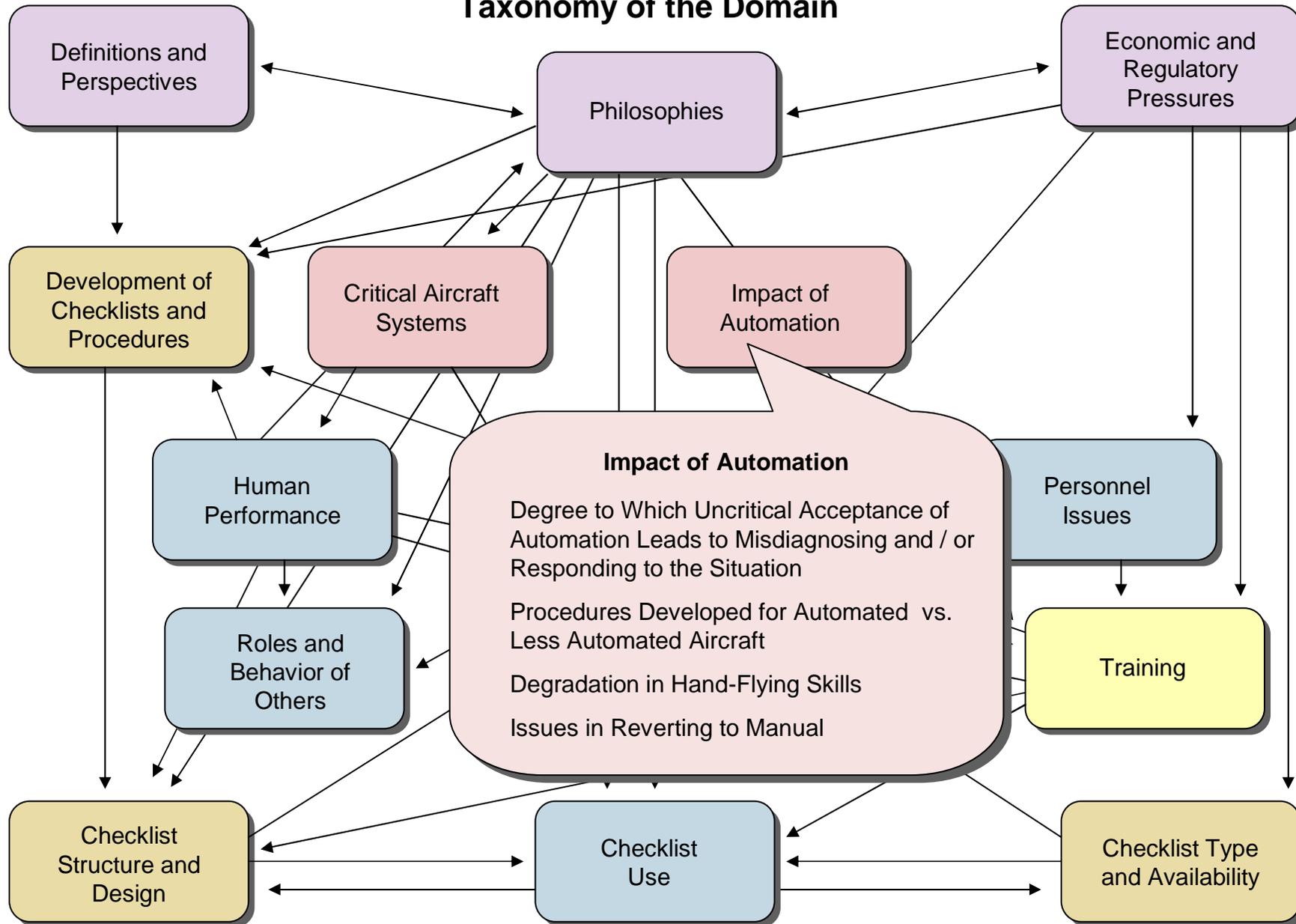
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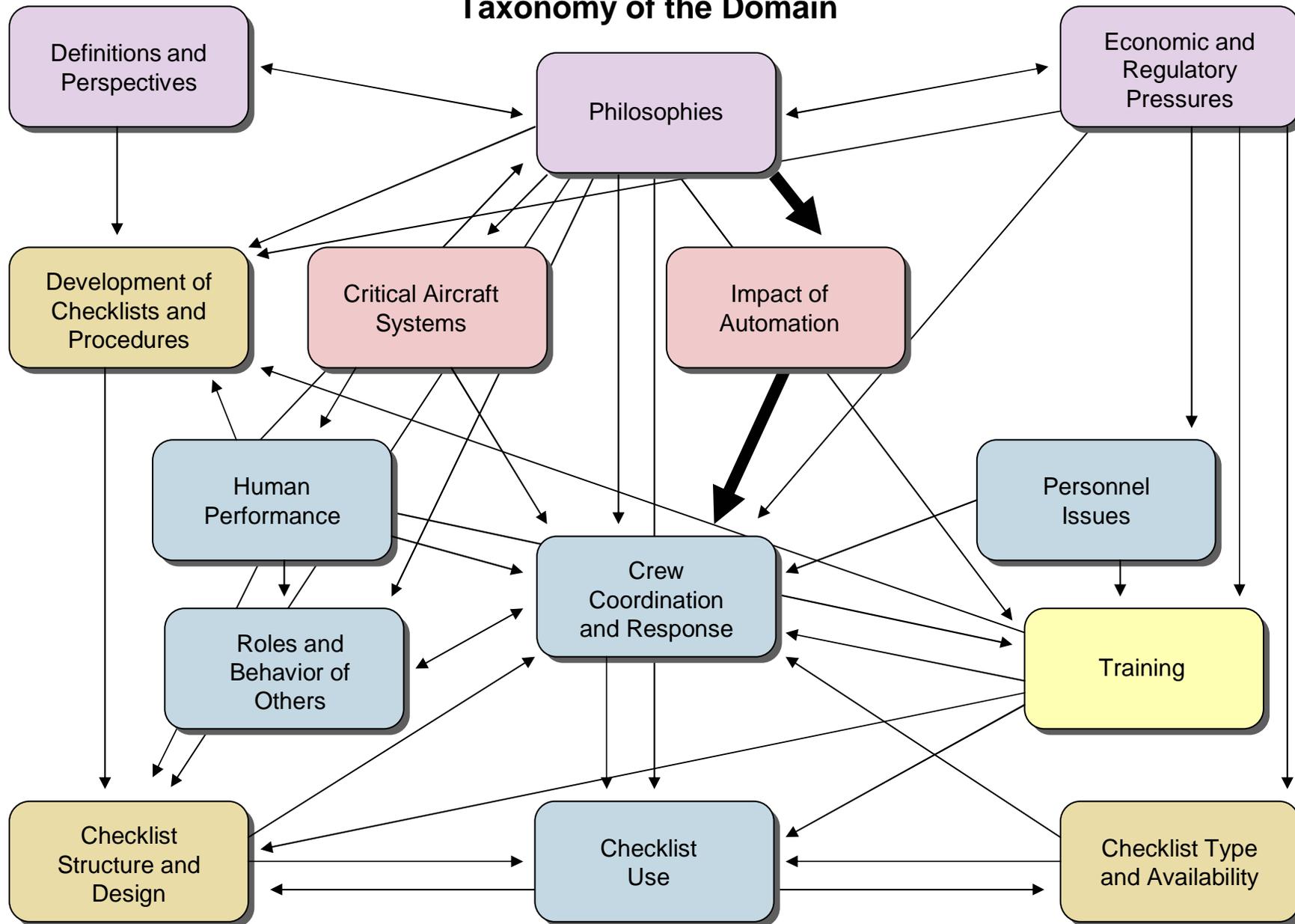
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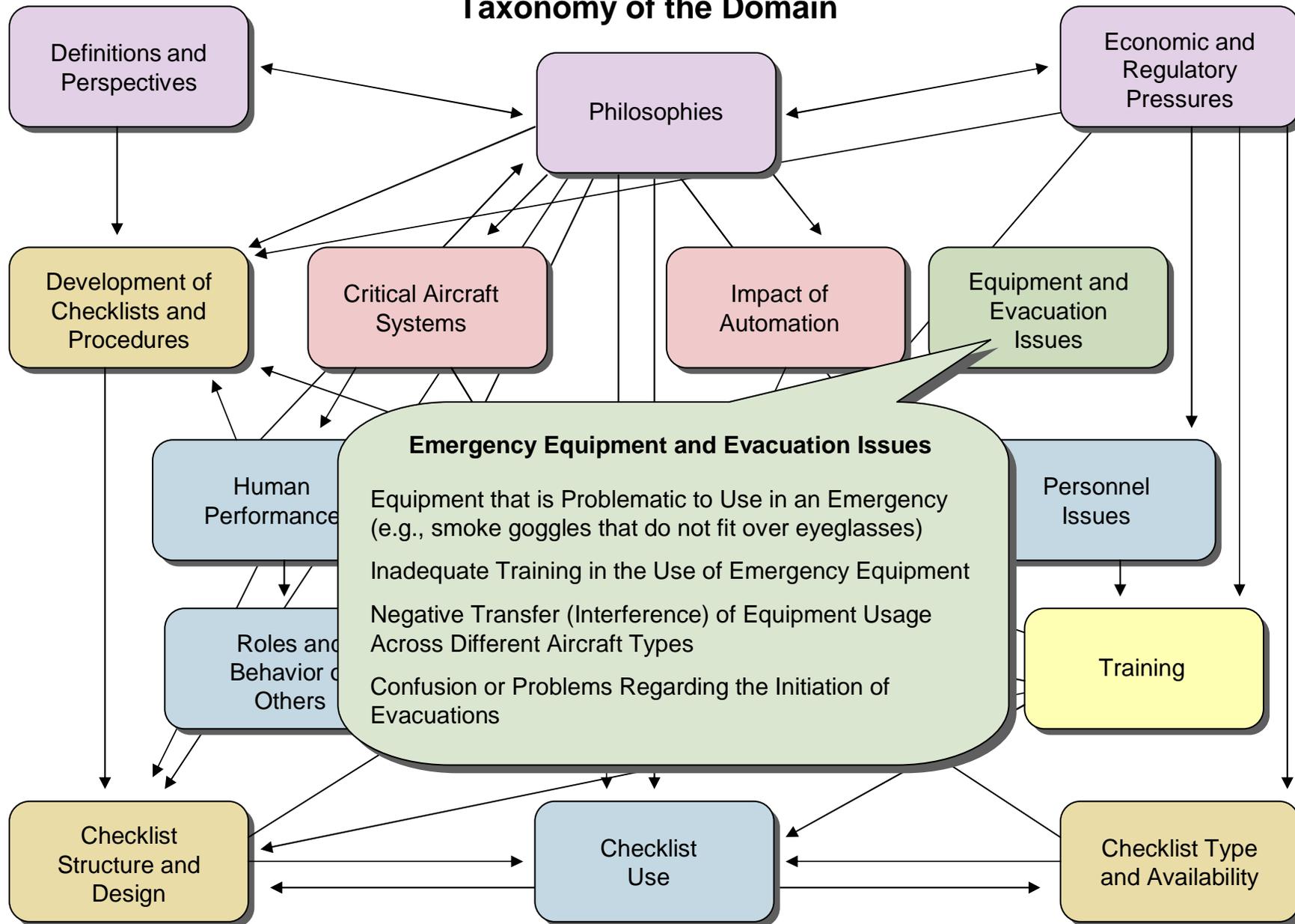
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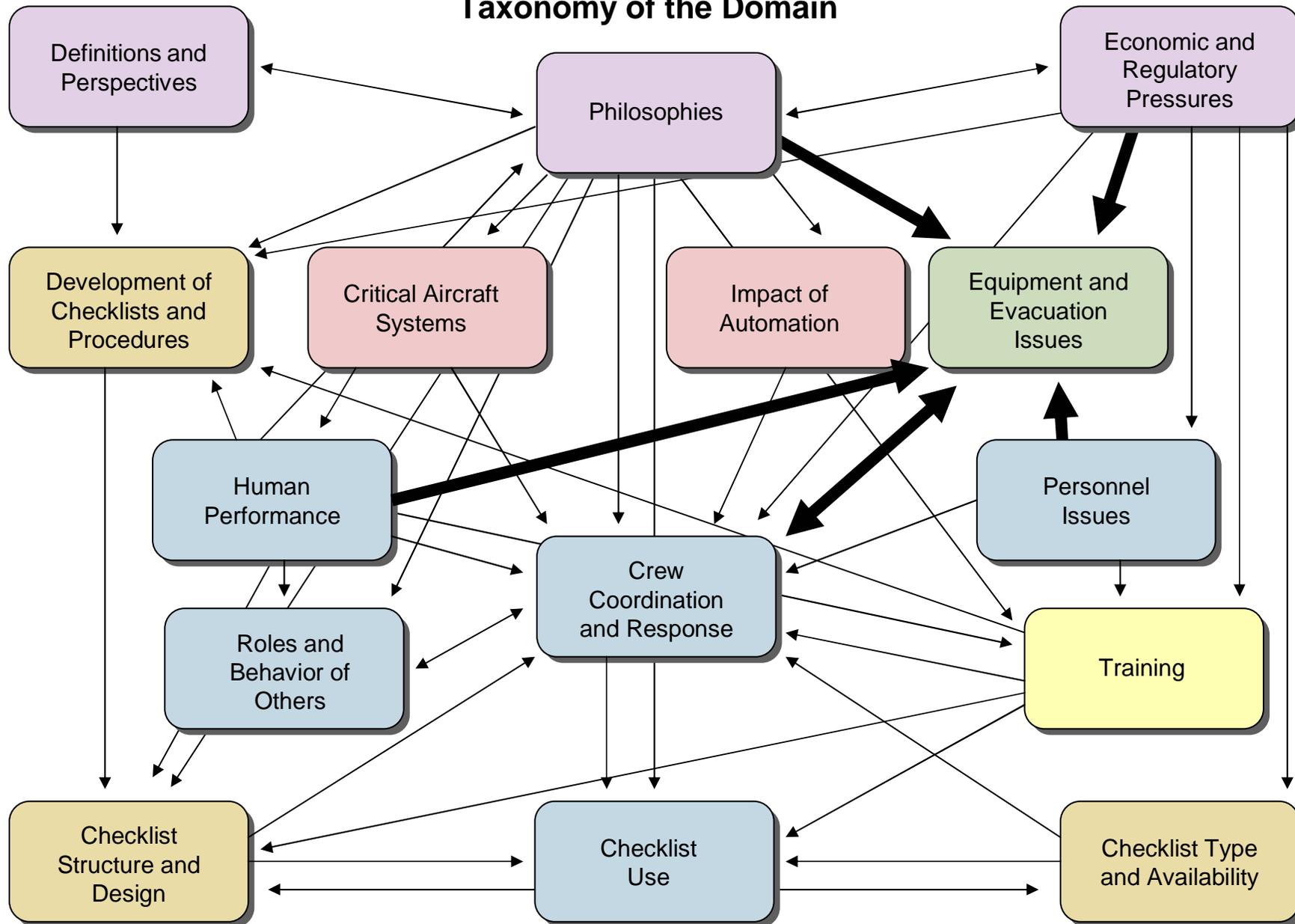
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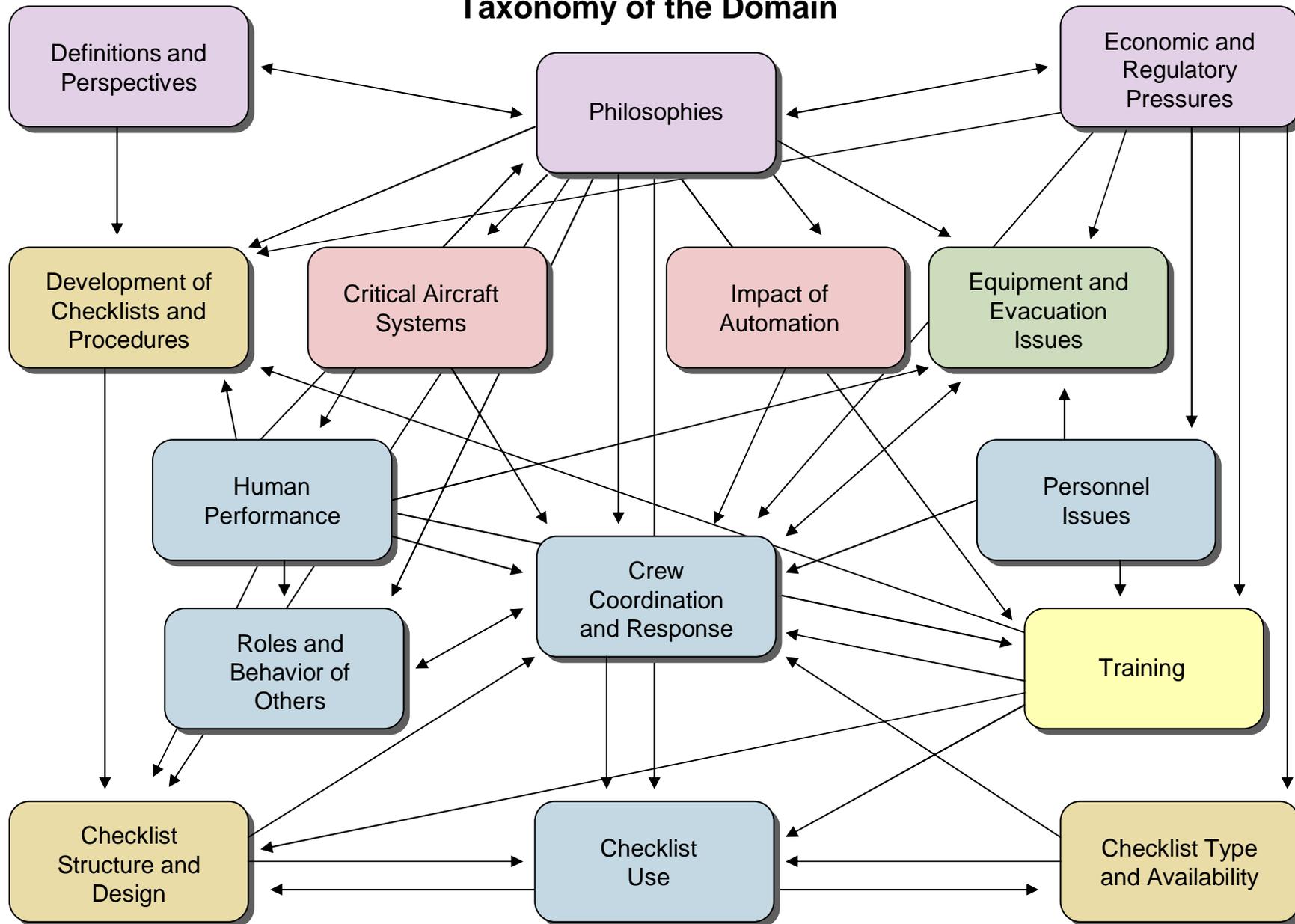
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Scope of the Project

- Part 121 and Part 135 operations
- United States domestic operations
- Flight deck centric
- Temporal window: from the beginning of the situation through the initiation of an evacuation (if any)



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Approach

- Review: all existing guidelines, handbooks, bulletins, reports, recommendations, documents, and pertinent literature
- Analyze: ASRS reports, NTSB and FAA accident reports
- Study: philosophies, policies, practices, and procedures currently in use by manufacturers and air carriers
- Observe: normal air carrier operations, initial and recurrent emergency and abnormal training for flight crews
- Interview: manufacturer procedure developers, procedure certifiers, POIs, air carrier management, instructors, pilots, cabin crew, dispatchers, maintenance personnel, air traffic controllers, etc.
- Conduct: surveys, field studies, simulator studies, experimental lab studies



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A Few Current and Recently Completed Studies

- Current Practices in Emergency and Abnormal Training for Flight Crews
- Boeing Checklist Development Process, Design, and Philosophy: B777 ECL and QRH, B737 QRH
- Non-normal Checklists: Issues in Philosophy, Design, and Use
- B737 QRH Comparison
- Stress and Cognition – A Review of the Scientific Literature
- Declaring Emergencies: Fact and Fiction
- Pilot Critical Incident Interviews
- Emergency and Abnormal Situations: ASRS Incident and NTSB Accident Reviews



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Goal

Develop guidance for procedure development and certification, training, crew coordination, and situation management based on knowledge of the operational environment, human performance limitations, and cognitive vulnerabilities in real-world situations.



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Products and Deliverables

Intermediate Products:

Reports, Articles, Papers, Presentations

End Products:

Field Guides for

- Training Entities and Instructors
- Operators
- Manufacturers
- Regulatory Agencies
(Certification, POIs)



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